Performance Measures

How Often are Potential Patient Safety Events Present on Admission?

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For the past 20 years, health services researchers have argued the importance of differentiating between medical conditions that are present on admission (POA) and medical conditions arising during the hospital stay, which could include complications of care and other adverse events. POA coding has been available in New York and California hospital discharge data for over a decade. Fields for POA were added to administrative claims data in 2007 as part of revisions to the Uniform Bill (UB-04) used for hospital payment,[1] and the Deficit Reduction Act of 2005 effectively requires coding of the POA indicator for all Medicare inpatient claims starting in January 2008.[2] As a result, this information should become more widely available for research and quality monitoring in the future.

The California Office of Statewide Health Planning and Development (OSHPD) fully implemented POA coding in 1996, and because of the demonstration of POA data quality problems,[3] OSHPD staff worked diligently to improve coding. The New York State Department of Health (NYSDOH), through its Statewide Planning and Research Cooperative System (SPARCS), implemented POA data collection in 1994. NYSDOH staff have indicated that the POA coding was inaccurate in early years, and consequently POA indicators were largely ignored by researchers and languished from disuse. However, New York has recently focused efforts on communicating the value of POA information to hospitals and coders and has provided training to medical coders in an attempt to

Article-at-a-Glance

Background: Data fields that capture whether diagnoses are present on admission (POA)—distinguishing comorbidities from potential in-hospital complications—became part of the Uniform Bill for hospital claims in 2007. The AHRQ Patient Safety Indicators (PSIs) were initially developed as measures of potential patient safety problems that use routine administrative data without POA information. The impact of adding POA information to PSIs was examined.

Methods: Data were used from California (CA) and New York (NY) Healthcare Cost and Utilization Project (HCUP) state inpatient databases for 2003, which include POA codes. Analysis was limited to 13 of 20 PSIs for which POA information was relevant, such as complications of anesthesia, accidental puncture, and sepsis.

Results: In New York, 17% of cases revealed suspect POA coding, compared with 1%–2% in California. After suspect records were excluded, 92%–93% of secondary diagnoses in both CA and NY were POA. After incorporating POA information, most cases of decubitus ulcer (86%–89%), postoperative hip fracture (74%–79%), and postoperative pulmonary embolism/deep vein thrombosis (54%–58%) were no longer considered in-hospital patient safety events.

Discussion: Three of 13 PSIs appear not to be valid measures of in-hospital patient safety events, but the remaining 10 appear to be potentially useful measures even in the absence of POA codes.

improve the accuracy of the information.[4]

Neither California nor New York has performed systematic validation studies of the accuracy of the POA indicators. A few researchers have attempted to assess face validity or have conducted small-scale re-abstraction studies to verify the coding of the POA indicators. For example, Naessens and colleagues[5] conducted a small re-abstraction study which showed that coders were able to collect POA indicators reliably. In a study by Hughes and colleagues[6] of potentially preventable complications, which was based on California data for 1999–2000, about 77% of California hospitals, with about 90% of eligible discharges, passed strict edit checks on their coding of POA indicators. Quan et al. found considerable disagreement between hospital-reported data and nurse-recorded data on POA status in three Calgary-area hospitals; administrative data had a lower proportion of complications for 9 of 12 conditions examined.[7]

Since POA coding became available in New York and California, a growing body of literature has argued that the use of POA "flags" would produce more valid results for mortality risk assessment, risk adjustment, and outcomes research.[7–15] For example, Glance and colleagues[16] found that the POA indicator would significantly enhance the ability of two comorbidity algorithms to accurately map *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnoses to comorbidity categories. Using year 2000 California discharge data with POA indicators, they showed that the Dartmouth/ Charlson Index underestimated the prevalence of certain conditions by up to 70% when POA information was ignored and comorbidities were ascertained only from previous hospitalizations. Similarly, the Elixhauser/Agency for Healthcare Research and Quality (AHRQ) comorbidity algorithm misclassified complications as preexisting conditions in up to 43% of the cases when POA information was ignored.

AHRQ sponsored the development of Patient Safety Indicator (PSI) software, which uses administrative claims data to flag potential safety events based on diagnoses, procedures, and other information contained in hospital discharge records. The PSI software uses secondary diagnoses, some of which might be present on admission, to help hospitals identify potential adverse events that could benefit from further investigation. The 20 PSIs were designed to reflect quality of care inside hospitals, providing information on potential hospital complications and adverse events following surgeries, procedures, and childbirth. These measures were developed by investigators at AHRQ, Stanford University, and the University of California after a comprehensive literature review, analysis of ICD-9-CM codes, review by a clinician panel, implementation of risk adjustment, and empirical analyses.[17] The original PSIs were developed using routine administrative data without POA information; however, a recently released version accommodates POA indicators.

The AHRQ Quality Indicators, including the PSIs, are being used for national assessments of quality of care[18] and for internal quality improvement efforts by a wide range of organizations, including regional health care systems encompassing inpatient and outpatient care; hospital data initiatives; employers; vendors that market software and information to hospitals; and MedPAC, an organization that prepares analyses and reports for Congress on Medicare payment policy.[19] In addition, some organizations, such as the Florida Agency for Health Care Administration (http://www.floridahealthfinder.gov/) and Norton Healthcare (http://www.nortonhealthcare.com/ about/ qualityreport/index.aspx), have used these indicators to produce Web-based, publicly available comparative reports on hospital quality. The Centers for Medicare & Medicaid Services (CMS) and health care organizations have incorporated selected PSIs into pay-for-performance demonstration projects or similar programs. With the expanded use of quality indicators generally, and PSIs in particular, it is critical to assess their strengths and weaknesses. Medicare's plans to stop paying hospitals for the additional costs of treating certain preventable conditions and events[20] further support the need for valid POA information.

We evaluated the use of information on whether diagnoses are present at the time of admission to the hospital to (1) assess the face validity of POA information in two states, (2) evaluate the relationship between POA information and the PSIs, and (3) examine the extent to which the PSIs defined without POA information are valid measures of hospital-level quality of care.

Methods

Databases

We employed two statewide all-payer inpatient discharge

Healthcare Cost and Utilization Project (HCUP) databases containing records for hospital inpatients discharged during calendar year 2003—the California and New York Statewide Inpatient Databases (SIDs). Discharge data processed through HCUP are converted into a uniform format to allow for state-to-state comparisons and for incorporation into national databases. The California SID contained more than 3.8 million discharge records from 373 nonfederal, short-term, acute care, nonrehabilitation hospitals; the New York SID contained more than 2.5 million discharge records from 233 nonfederal, short-term, acute care, nonrehabilitation hospitals.* On each discharge record, the California and New York SID supplied POA flags for up to 25 diagnoses and 15 diagnoses, respectively. Valid POA flags took values of 0 or 1, depending on whether the diagnosis was absent or present on admission. For this study, we were concerned with the effect of POA flags on secondary diagnoses. Consequently, we ignored the POA flag associated with the principal diagnosis. In both states, POA flags were not recorded for external cause of injury codes (E-codes).

POA Coding

POA coding appeared suspect for some hospitals and some discharge records in these databases. We eliminated hospitals for which every POA flag was set to 0, for which every POA flag was set to 1, or for which more than 10% of POA flags were missing for secondary diagnoses other than E-codes. For hospitals that passed these screens, we applied three alternative approaches to all diagnoses with missing POA flags (except E-codes):

1. We posited that all such diagnoses were present on admission (which would most often change the determination of whether the case had a patient safety event)
2. We posited that no such diagnoses were present on admission (which would be less likely to change the determination of whether the case had a patient safety event)
3. We deleted all records with such diagnoses from our final analyses.

We present only the results based on approach 3 because neither approach 1 nor approach 2 changed the positive predictive value, as defined below, by more than 1%.

* Based on coding in the American Hospital Association Annual Hospital Survey.

PSIs

One objective was to test the effect of POA flags on the rate of patient safety events, as measured by AHRQ's set of 20 hospital-based PSIs. We applied Version 3.0 of AHRQ's PSI software to the California and New York data.[21] We excluded those PSIs with numerators that were based on procedure codes or discharge status (death in low mortality diagnosis-related groups [DRGs], failure to rescue, and postoperative wound dehiscence) because POA flags pertain only to diagnoses. We also eliminated from consideration 4 PSIs associated with births because birth-related events were never present on admission. We therefore analyzed the effect of the POA flags on the incidence rates of 13 PSIs: complications of anesthesia, decubitus ulcer, foreign body left during procedure, iatrogenic pneumothorax, selected infections due to medical care, postoperative hip fracture, postoperative hemorrhage and hematoma, postoperative physiologic and metabolic derangements, postoperative respiratory failure, postoperative pulmonary embolism (PE) or deep vein thrombosis (DVT), postoperative sepsis, accidental puncture or laceration, and transfusion reaction.

Analyses were performed with and without risk adjustment. In the PSI software, risk adjustment is performed using information on the patient's age, gender, comorbidities,[22] and modified DRGs, in which DRGs are collapsed across those with and without comorbidities and complications. To focus on the impact of POA coding on outcome ascertainment, POA indicators were not used in risk adjustment.

Comparison of PSI Rates With and Without POA Information

To compare hospital PSI rates without POA information to hospital PSI rates with POA information, we eliminated secondary diagnoses that were present on admission. Secondary POA diagnoses were eliminated from the numerator logic of the PSI program (event determination), not from the denominator logic (population at risk). Therefore, PSI rates decreased, but never increased, when secondary diagnoses were eliminated. This logic focuses on identifying false positive cases, in which the PSI–defining diagnosis was actually present at admission, and therefore not a complication of inpatient care. However, it ignores the potential of POA information to

Table 1. Missing Present-on-Admission (POA) Flags in California and New York, 2003 SID*

	California			New York		
	Number of Discharges	Number of Secondary Diagnoses	Percent of Secondary Diagnoses Missing POA	Number of Discharges	Number of Secondary Diagnoses	Percent of Secondary Diagnoses Missing POA
Total	3,807,527	17,096,800	0.23	2,502,087	10,186,646	8.28
Hospital Bed Size						
< 100	345,267	1,433,215	0.30	94,730	433,353	0.55
100–299	1,842,428	8,382,971	0.30	773,297	3,306,299	7.17
300–499	1,073,788	4,858,370	0.16	594,726	2,524,678	4.28
500+	546,044	2,422,244	0.12	1,039,334	3,922,316	12.65
Hospital Location						
Rural	95,498	410,128	0.27	132,799	617,469	0.28
Urban	3,712,029	16,686,672	0.23	2,369,288	9,569,177	8.79
Hospital Ownership						
Government	634,884	2,496,733	0.35	315,164	1,161,655	0.07
Nonprofit	2,529,583	11,815,638	0.20	2,170,493	8,960,904	9.40
Investor owned	643,060	2,784,429	0.26	16,430	64,087	0.14
Hospital Teaching						
Nonteaching	2,714,459	12,360,140	0.24	899,850	3,897,612	3.04
Teaching	1,093,068	4,736,660	0.23	1,602,237	6,289,034	11.52

* Includes all discharges from community, nonrehabilitation hospitals before applying exclusions on the basis of suspect coding of POA.
SID, statewide inpatient database.

identify false negative cases, in which a patient safety event is incorrectly disqualified because of a secondary diagnosis that actually developed after admission.

To measure changes in the magnitudes of PSI rates, we calculated the proportion of patients with a PSI whose designation was not overturned by the POA flag. This parameter was defined by Glance et al.[16] and Quan et al.[11] as the positive predictive value (PPV), or one minus the false positive error rate, under the assumption that hospital's reporting of POA information is correct. In our construct, the gold standard was based on the PSI flags that remained after POA diagnoses were eliminated. We recognize that the true PPV may be lower, if hospitals erroneously reported PSI–defining diagnoses. More likely, the true PPV would be higher, because hospitals have been shown to err on the side of labeling complications as POA (for example, 9 of 12 complication diagnoses were overreported as POA in a Canadian study).[10]

To measure the change in hospital rates and rankings, we calculated both weighted Pearson and Spearman rank correlation coefficients between the hospital-level PSI rates before and after eliminating the POA diagnoses. Values of the correlation coefficient near one imply good agreement between the two sets of hospital rates or rankings, meaning that the original rates or rankings that include the POA diagnoses are highly associated with the new rates or rankings that exclude the POA diagnoses. Only the weighted correlation coefficients are shown, because they are more robust than the rank correlation coefficients in the setting of many hospitals with zero outcomes (that is, no cases with a particular PSI).

Results

Secondary Diagnoses Missing POA Flags

Table 1 (above) shows the percentage of secondary diagnoses missing their POA flags before any discharges or hospitals were excluded. To illustrate hospitalwide coding quality, this table includes all discharges from nonfederal, short-term, acute care hospitals, including discharges under the age of 18. Overall, the percentage of secondary

Table 2. Diagnoses Not Present on Admission (POA) in California and New York, 2003 SID, After Eliminating Hospitals and Records with Suspect POA Coding*

	California			New York		
	Number of Discharges	Number of Secondary Diagnoses	Percent of Secondary Diagnoses Not POA	Number of Discharges	Number of Secondary Diagnoses	Percent of Secondary Diagnoses Not POA
All	2,987,203	15,736,581	6.31	1,733,420	8,126,729	8.01
Hospital Bed Size						
< 100	277,138	1,348,335	4.43	78,409	405,579	7.52
100–299	1,422,057	7,674,861	5.95	567,629	2,744,013	7.16
300–499	857,050	4,523,399	6.53	405,319	1,998,613	8.24
500+	430,958	2,189,986	8.31	682,063	2,978,524	8.71
Hospital Location						
Rural	77,317	385,977	5.06	112,119	585,334	8.34
Urban	2,909,886	15,350,604	6.35	1,621,301	7,541,395	7.98
Hospital Ownership						
Government	500,459	2,248,198	6.21	253,934	1,041,050	7.30
Nonprofit	1,974,278	10,882,710	6.32	1,465,274	7,023,334	8.12
Investor owned	512,466	2,605,673	6.40	14,212	62,345	7.35
Hospital Teaching						
Nonteaching	2,161,726	11,528,657	5.97	691,265	3,370,778	7.08
Teaching	825,477	4,207,924	7.27	1,042,155	4,755,951	8.67

* Includes discharges for adults, 18 years and older from community, non-rehabilitation hospitals after excluding hospitals and records with suspect coding of POA. SID, statewide inpatient database.

diagnoses with missing POA flags was substantially lower for California (0.23%) than New York (8.28%).

In New York, missing value rates for POA flags were considerably higher for hospitals with more than 500 beds, for urban hospitals, for nonprofit hospitals, and for teaching hospitals, compared with the missing value rates for other types of hospitals. In California, there was less variation in missing value rates across hospital types.

After the screening process to eliminate hospitals and records with questionable POA coding, 367 hospitals were retained out of 373 hospitals in California (98.4%). These 367 hospitals contained 3,009,447 adult discharges out of 3,014,874 adult discharges (99.8%). A total of 22,244 discharge records (0.7%) had at least one missing POA flag. In New York, we kept 193 out of 233 hospitals (82.8%), which contained 1,748,995 adult discharges out of 2,100,413 adult discharges (83.3%). A total of 15,575 discharge records (0.7%) had at least one missing POA flag.

Secondary Diagnoses Not POA

Table 2 (above) shows the percentage of secondary diagnoses (excluding E-codes) that were not POA in the analysis file after eliminating hospitals with suspect POA coding. These estimates reflect the percentage of secondary diagnoses that were retained in the second application of the PSI software after eliminating POA diagnoses from the numerator logic for patients 18 years and older. Overall, a higher percentage of secondary diagnoses were not POA for New York (8.0%) than California (6.3%). In both states, the percentage not POA tended to be higher for larger hospitals and for teaching hospitals.

PSI Events Remaining After Excluding POA Secondary Diagnoses

Table 3 (page 159) displays the percentage of cases with a PSI event that remained after all secondary diagnoses that were flagged as POA were excluded. In California, only 11.1% of cases with a decubitus ulcer were consid-

Table 3. Percentage of Patient Safety Indicator (PSI) Events Remaining After Removing Secondary Diagnoses That Were POA, 2003*

	California		New York	
Patient Safety Indicator	Number of Events	Percent Remaining	Number of Events	Percent Remaining
PSI 1: Complications of Anesthesia	934	100.0	284	100.0
PSI 3: Decubitus Ulcer	17,789	11.1	16,425	14.0
PSI 5: Foreign Body Left During Procedure	258	64.3	169	75.7
PSI 6: Iatrogenic Pneumothorax	1,256	72.6	782	65.2
PSI 7: Infection Due To Medical Care	4,286	64.9	2,406	64.6
PSI 8: Postoperative Hip Fracture	106	20.8	69	26.1
PSI 9: Postoperative Hemorrhage or Hematoma	1,800	79.1	859	71.4
PSI 10: Postoperative Physiologic and Metabolic Derangement	686	76.5	228	63.6
PSI 11: Postoperative Respiratory Failure	2,374	93.5	1,312	93.2
PSI 12: Postoperative PE or DVT	6,715	45.9	5,318	42.5
PSI 13: Postoperative Sepsis	865	73.4	453	70.0
PSI 15: Accidental Puncture/Laceration	9,107	87.3	3,743	87.0
PSI 16: Transfusion Reaction	12	58.3	9	77.8

* POA, present on admission; PE, pulmonary embolism; DVT, deep vein thrombosis.

ered to have that PSI after we eliminated diagnoses that were reported as POA. At the other extreme, for complications of anesthesia, 100% of cases still had the PSI after we eliminated secondary diagnoses that were present on admission. For most indicators, the percentages were similar between California and New York.

For 10 PSIs in both California and New York, considerably more than half and usually more than two-thirds of cases were still considered potential patient safety problems after eliminating conditions reported as POA–complications of anesthesia, foreign body left during procedure, iatrogenic pneumothorax, infection due to medical care, postoperative hemorrhage, postoperative physiologic derangement, postoperative respiratory failure, postoperative sepsis, accidental puncture or laceration, and transfusion reaction. For the 3 remaining indicators, fewer than half of the cases were still considered potential patient safety problems—decubitus ulcer, postoperative hip fracture, and postoperative PE or DVT.

Effect of POA Information on Hospital Ratings

To assess the effect of POA information on hospital performance ratings, we calculated weighted Pearson correlations between the hospital-level PSI rates before and after excluding conditions that were reported as POA. The results are shown in Table 4 (page 160) for both observed and risk-adjusted PSI rates. The weighted correlations were generally higher in California than in New York (for example, r = 0.86 versus r = 0.78 for iatrogenic pneumothorax; r = 0.92 versus r = 0.58 for postoperative physiologic/metabolic derangement). Consistent with the low percentage of decubitus ulcer events that remained after adding POA information (Table 3), the decubitus ulcer PSI had the lowest weighted correlation of any of the PSIs (r = 0.40 in California and r = 0.41 in New York, after risk adjustment). Weighted correlations for postoperative hip fracture and postoperative PE or DVT were also low to moderate (0.42–0.47 for hip fracture and 0.42–0.78 for PE/DVT, after risk adjustment). Altogether, 11 of the 13 PSIs had hospital-level correlations of ≥ 0.71 in California, and 10 had correlations in this range in New York.

For a visual perspective of these correlations, Figure 1 (page 161) plots the hospital rates for decubitus ulcer, with weighted correlations (without risk adjustment) of 0.29 in California and 0.47 in New York. Figure 2 (page 161)

Table 4. Pearson Correlations (Weighted) Between Hospital-Level Patient Safety Indicator (PSI) Rates Before and After Dropping POA Diagnoses, 2003*

Patient Safety Indicator	California Observed	California Risk Adjusted	New York Observed	New York Risk Adjusted
PSI 1: Complications of Anesthesia	1.00	1.00	1.00	1.00
PSI 3: Decubitus Ulcer	.29	.40	.47	.41
PSI 5: Foreign Body Left During Procedure	.89	NA	.94	NA
PSI 6: Iatrogenic Pneumothorax	.90	.86	.83	.78
PSI 7: Infection Due To Medical Care	.91	.90	.88	.85
PSI 8: Postoperative Hip Fracture	.47	.47	.34	.42
PSI 9: Postoperative Hemorrhage or Hematoma	.87	.85	.86	.86
PSI 10: Postoperative Physiologic and Metabolic Derangement	.94	.92	.78	.58
PSI 11: Postoperative Respiratory Failure	.99	.98	.99	.98
PSI 12: Postoperative PE or DVT	.80	.78	.41	.42
PSI 13: Postoperative Sepsis	.72	.71	.82	.80
PSI 15: Accidental Puncture/Laceration	.97	.95	.96	.95
PSI 16: Transfusion Reaction	.72	na	.92	NA

* POA, present on admission; NA, not available; PE, pulmonary embolism; DVT, deep vein thrombosis.

plots the hospital rates for postoperative hemorrhage or hematoma, with weighted correlations (without risk adjustment) of 0.85 in California and 0.86 in New York. The horizontal axis indicates the hospital's PSI rate using all diagnoses, and the vertical axis indicates the hospital's PSI rate excluding diagnoses reported as POA. The size of each circle is proportional to the size of the PSI denominator for that hospital. In these plots, all hospitals fall below the 45-degree line because the PSI rate without POA diagnoses cannot be higher than the PSI rate with POA diagnoses. Of note is the wide dispersion for decubitus ulcer, indicating poor agreement between rates of this indicator before and after eliminating POA diagnoses. On the other hand, rates for postoperative hemorrhage and hematoma tend to fall along the diagonal, indicating better agreement before and after dropping POA diagnoses.

Decubitus Ulcer PSI

We further investigated the decubitus ulcer PSI, which had the lowest agreement rate and generally the lowest hospital-level correlation. In particular, we examined the admission source for patients, which was available in detail for California, as shown in Table 5 (page 162). Uniform Billing (UB)-92 and UB-04 reporting requirements force hospitals to classify admission source as either "emergency room" or "transfer from a skilled nursing facility" (or other types of facilities), but not both. California's unique reporting scheme allows hospitals to designate both the site from which the patient was admitted (for example, home or skilled nursing care) and the route of admission (for example, emergency room); the latter variable takes precedence over the former when California's data are simplified to match uniform HCUP specifications imposed to make the data comparable to other HCUP data. Hence, using California data as originally reported to HCUP, we were able to ascertain whether "false-positive" decubitus ulcers, on the basis of POA coding, were concentrated among transfers unrecognized in the HCUP version of the California data.

Among all patients with this PSI, 18.6% were admitted from a skilled nursing facility (but labeled as emergency room admissions in HCUP). Compared with patients admitted from a skilled nursing facility, patients admitted from home were about 3.5 times more likely to have their decubitus ulcers flagged as safety events after eliminating

Plots of Hospital Rates Before and After POA Elimination for Decubitus Ulcer, 2003

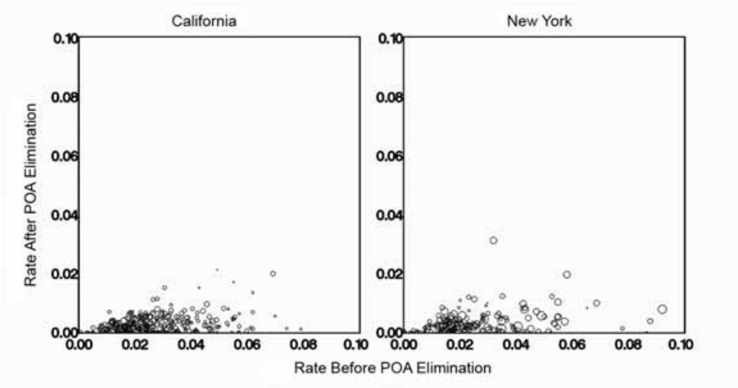

Figure 1. *The horizontal axis indicates the hospital's patient safety indicator (PSI) rate using all diagnoses, and the vertical axis indicates the hospital's PSI rate excluding diagnoses reported as present on admission (POA).*

Plots of Hospital Rates Before and After POA Elimination for Postoperative Hemorrhage or Hematoma, 2003

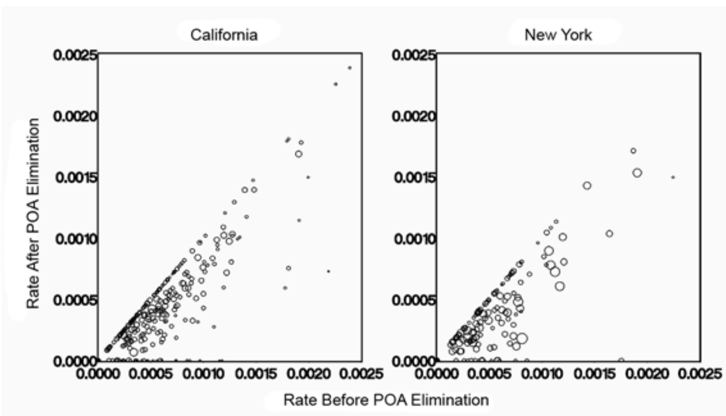

Figure 2. *The horizontal axis indicates the hospital's patient safety indicator (PSI) rate using all diagnoses, and the vertical axis indicates the hospital's PSI rate excluding diagnoses reported as present on admission (POA).*

diagnoses reported as POA (13.0% versus 3.5%). However, even among patients who were not transferred from ineligible sites of care, such as inpatient hospitals and skilled nursing facilities, nearly 87% of decubitus ulcers were reported as POA. As a result, even if the "admission source" variable were refined to allow hospitals nationwide to report both the site and route of admission, the vast majority of decubitus ulcer PSI cases still would be incorrectly identified as in-hospital safety events.

Hip Fracture PSI

The hip fracture PSI also had very low rank correlations and rates of agreement before and after eliminating POA diagnoses. Our individual review of all these apparent false-positive cases from California (*n* = 106) revealed that most either never had a hip fracture repair procedure (*n* = 47) or that the hip fracture repair procedure was performed after another major procedure, such as coronary artery bypass graft surgery, percutaneous coronary intervention, or abdominal aortic aneurysm repair (*n* = 16). The PSI logic relies on the relative timing of each patient's "index" procedure and his or her hip fracture repair to label the hip fracture as "postoperative;" this logic fails when patients' fractures are treated medically or are repaired after another major surgery.

Discussion

This study revealed substantial differences in the face validity of POA coding in California and New York. Because of suspect POA coding, we eliminated from our analyses more hospitals and cases from the New York data (about 17% of hospitals and 17% of cases) than we did from the California data (about 1.6% of hospitals and 0.2% of cases). Coding differences were apparent across hospital types. In New York, large hospitals (500 beds or more), urban hospitals, not-for-profit hospitals, and teaching hospitals had the largest percentages of records with missing values. However, with diligence and training, such differences can be eliminated, as shown in California. The efforts of the California OSHPD to inform coders and improve coding accuracy appear to have resulted in more complete coding of POA information. This bodes well for national implementation

Table 5. Percent of Decubitus Ulcer Events That Remained After Eliminating Diagnoses POA, California 2003*

	n	Percent Remaining
All decubitus ulcer cases	17,789	11.1
Admission source		
Home	13,927	13.0
Residential care, through the ED	357	6.4
Skilled nursing/intermediate care through the ED	3,283	3.7
Acute inpatient hospital through the ED	72	8.3
Other inpatient hospital through the ED	36	2.8
Other	114	14.0

* POA, present on admission; ED, emergency department.

and illustrates that, with appropriate guidance for hospital coders, this information can be obtained on a wide scale.

After deleting hospitals and records with questionable coding of POA, it appears that the coding of POA information is fairly consistent between the two states. In California, 93.4% of secondary diagnoses were coded as POA, and New York had a comparable rate (91.9%). Results across the PSIs were also generally consistent between the two states; weighted hospital-level correlations were similar for seven indicators, higher in California for six indicators, and higher in New York for one indicator (postoperative sepsis).

For most PSIs, the impact of removing secondary conditions that were present on admission was moderate. For 10 of the 13 indicators evaluated, over half and generally two-thirds or more of the safety events remained, and the hospital-level weighted correlations were > 0.71 between PSI rates before and after deleting POA diagnoses in California. These findings suggest that for this subset of 10 PSIs—complications of anesthesia, foreign body left during procedure, iatrogenic pneumothorax, infection due to medical care, postoperative hemorrhage, physiologic derangement, respiratory failure, sepsis, accidental puncture/laceration, and transfusion reaction—the algorithms are fairly robust, especially if they are used as screening tools to identify cases for in-depth peer review.

On the other hand, this study revealed major weaknesses in three PSIs. For the decubitus ulcer indicator, very few cases were still identified as patient safety events once POA diagnoses were dropped from the numerator logic. Another study involving medical record abstraction sounded similar warnings about this indicator's validity.[23] Although the decubitus ulcer PSI may still be a valuable tool for identifying the presence of pressure sores regardless of setting, this analysis raises serious questions about using it to identify decubitus ulcers that begin in the hospital. The decubitus ulcer PSI may be more appropriately redefined as a Prevention Quality Indicator, a measure that uses hospital data to identify potential quality of care problems outside the hospital.

The postoperative hip fracture PSI was often overturned when incorporating POA information because the PSI logic relies on questionable assumptions about the use and timing of surgery for fracture repair. Finally, fewer than half of the postoperative PE and DVT events remained after dropping POA diagnoses, and the weighted hospital-level correlations were 0.41 and 0.80 in New York and California, respectively. Given the high prevalence of chronic or preexisting DVTs, this PSI should not be viewed as an indicator of patient safety inside the hospital. The preventability of PE and DVT suggests that the indicator may be used as a more general measure of quality of care, encompassing both inpatient and outpatient settings. However, with the addition of POA information, the postoperative PE/DVT indicator may become a more valid measure of in-hospital patient safety.

These data are subject to several limitations. We have no independent validation of whether reported PSI events were actually POA; our results are based entirely on POA information reported by hospitals themselves. Given that more than 91% of all secondary diagnoses are reported as POA, in both California and New York, it is possible that hospitals may default the value of this variable to "present on admission" when the date of onset is not clearly documented. Concerns about medicolegal liability or public reporting of complication rates may also lead hospitals to code complications as "present on admission." Such bias may be especially problematic for conditions that are often missed during the admission process, such as a chronic decubitus ulcer or a DVT. Absent any clear evidence about when the condition started, coders may err on the side of assuming it was POA.

More generally, our data do not address many aspects of PSI validity, including the accuracy of diagnostic coding, the completeness of the source documents used by hospital coders, and the uncertain linkages between outcomes and processes of care. Finally, the fact that our data originated from only two states and one year may limit the generalizability of our results to other settings.

Conclusion

In conclusion, this analysis suggests that the validity of several PSIs, including particularly decubitus ulcer, postoperative hip fracture, and postoperative DVT or PE, is seriously compromised in the absence of POA information. Most other PSIs appear to have sufficient validity for screening cases with high likelihood of having quality of care problems and therefore for selecting charts for detailed review. A PPV of 64–94%, as reported for these other PSIs, may or may not be adequate for public reporting, depending on local circumstances and stakeholder views. Further research is needed to confirm the validity of POA coding in California and New York and to extend the current findings to other states and years. J

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